ONLINE HOT SPOT SUPPRESSION TO IMPROVE LOCOREGIONAL HYPERTHERMIA TREATMENTS.


2 Sponsor: KWF (UVA 2012-5393)

3 Background
Hyperthermia (HT), the application of elevated temperatures (41-45°C) to tumor tissue, is a powerful radio and chemo sensitizer. Randomised trials have demonstrated a significant improvement in tumor control and patient survival for cervical and other cancer sites by combining radiotherapy and HT. The results of clinical trials were positive in spite of the fact that goal temperatures rarely achieved in the tumor due to the incidence of unwanted hot spots in normal tissue. Clinical results can improve further when these treatment limiting hot spots could be suppressed. The 3-D power control of the latest generation phased array antenna systems for locoregional HT is capable of preventing hot spots. However, manual optimization of system settings is very difficult due to the large number of degrees of freedom of these systems, and pre treatment planning is presently not yet sufficiently reliable due to uncertainty in input data.

4 Purpose
To develop treatment planning guided active hot spot suppression to improve tumor temperatures. The method should be applicable for all locoregional HT patients.

5 Plan of investigation
Development and implementation of active hot spot suppression involves three steps:

i. Development of algorithms capable of adapting phase and amplitude settings to suppress hot spots occurring at any possible location.

ii. Pre-clinical tests: Computer simulations will be used to predict the performance of the developed algorithms under realistic clinical conditions, with emphasis on performance with limited temperature and E-field data, and uncertainty in tissue properties.

iii. Clinical validation: The performance of the algorithm will be validated in 20 cervical cancer patients treated with hyperthermia using the 70 MHz AMC-8 regional HT system. Each patient will receive five HT sessions, and each HT session will start with standard experience based phase and amplitude settings. When a hot spot occurs these settings will be corrected using the phase and amplitude shifts computed by the algorithm for that location, without inducing new hot spots at other locations.

7 contact name: Hans Crezee

6 selected publications


Figure 1: online computed temperature distribution for the current set of amplitude and phase settings during treatment.

Figure 2: temperature distributions resulting from two considerably different phase-amplitude settings with a comparable thermal dose in the centrally located tumor, but normal tissue heating is significantly different.